

Application No. 10/717,839
Docket No. DP-310030
Amendment dated January 23, 2006
Reply to Office Action of September 22, 2005

REMARKS

In the Office Action, the Examiner reviewed claims 1-20 of the above-identified US Patent Application, with the result that all of the claims were rejected. In response, Applicants have amended the claims as set forth above. More particularly:

The claims have been amended to specify that the recited "lamine substrate" is a "lamine organic substrate," and that the "solder joints" are "solder bumps." Support for these amendments can be found in Applicants' specification on page 4, lines 16-17, and page 5, lines 5-7.

Independent claim 1 has been further amended to incorporate limitations of its dependent claims 4 and 13.

Dependent claims 4 and 13 have been amended in view of the limitations incorporated into their parent claim 1.

Dependent claim 14 has been rewritten in independent form to include all of the limitations of its base claim 1.

Independent claim 18 and dependent claim 15 have been amended to recite that the stiffener has a modulus of elasticity of at least about ten times greater than the modulus of elasticity of the lamine organic substrate. Support for these amendments can be found in Applicants' specification on page 6, lines 19-24.

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Independent claim 18 has been further amended to incorporate limitations from claims 4 and 14.

Dependent claim 19 has been amended to recite the limitation of claim 6.

Claims 2 and 3 and have been canceled without prejudice.

Applicants believe that the above amendments do not present new matter. Favorable reconsideration and allowance of remaining claims 1 and 4-20 are respectfully requested in view of the above amendments and the following remarks.

Rejections under 35 USC §103

Independent claims 1 and 18 and their remaining dependent claims 4, 5, 7-10, 12, 15, 16, 19, and 20 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent No. 6,014,317 to Sylvester. Applicants respectfully request reconsideration of this rejection in view of the claims as amended and the following comments.

Each of independent claims 1 and 18 now require that the surface-mount device (18) is attached with a plurality of solder bumps (20) to the first surface (14) of the laminate organic substrate (12), and that the stiffener (24,124,224) is attached with a plurality of solder bumps (126 in Figure 2) to the

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second surface (16) of the laminate organic substrate (12) directly opposite the device (18), and that the solder bumps (126) space the stiffener (24,124,224) from the laminate organic substrate (12) to define a gap therebetween.

Dependent claim 4 and independent claim 18 further require that the gap formed by the solder bumps (126) between the substrate (12) and the stiffener (24,124,224) is completely filled with an underfill material (128).

Under this rejection, the Examiner explained that Figure 18 of Sylvester discloses a stiffener 132 attached to the second surface of a laminated substrate 126 with "a plurality of solder joints" that space the stiffener 132 from the substrate 126 to define a gap that is completely filled with an underfill material. However, Applicants can find no basis for the "plurality of solder joints" or the underfill material in Figure 18 or Sylvester's specification. The Examiner then concluded that, since Sylvester teaches that the stiffener 132 can be an electrical component such as a capacitor, the stiffener 132 would "have to be underfill adhesive same as real chip." However, Sylvester does not show a gap between the stiffener 132 and the substrate 126 to which it is mounted, nor does Sylvester provide any motivation for the creation of such a gap. Furthermore, Sylvester and the other prior art of record do not support the Examiner's conclusion that a capacitor would have to be underfilled, and it is the undersigned's understanding that underfilling is reserved for solder-

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bumped IC devices as described in Applicants' specification at pages 1 through 2. Therefore, Applicants respectfully believe that Sylvester does not disclose or suggest the invention recited in Applicants' independent claims 1 and 18 and dependent claim 4.

Also under this rejection, the Examiner cited Sylvester at column 10, lines 56-65, for disclosing attachment of Sylvester's stiffener 18 with at least one solder joint (as recited in Applicants' claims 3 and 19), and cited Figure 14 and column 17, lines 50-66, of Sylvester for disclosing the stiffener 18 as being larger than the device 18 and having a cross-shape (as recited in Applicants' claims 7-10). However, the teachings relied on by the Examiner do not pertain to Sylvester's stiffener 18, but to the "lid" 32 (Figure 2) placed over Sylvester's device 18. Therefore, these grounds for the rejection under 35 USC §103 are improper because the cited teachings are irrelevant to Sylvester's stiffener 18 as well as Applicants's stiffener (24,124,224).

In view of the above, Applicants respectfully request withdrawal of the rejection to the claims based on Sylvester.

Independent claim 1 and its remaining dependent claims 6, 7, 12, 13, and 15-17 were rejected under 35 USC §103(a) as being unpatentable over U.S. Patent No. 5,900,675 to Appelt et al. (Appelt). Claim 14, which originally

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depended from claim 1 and as amended incorporates all the limitations of claim 1, was also subject to this rejection and therefore will also be addressed here. Applicants respectfully request reconsideration of this rejection in view of the claims as amended and the following comments.

As noted above, independent claim 1 was amended to incorporate limitations of its dependent claim 4, which was not subject to the rejection under Appelt. Therefore, Applicants believe that this rejection as it applies to independent claim 1 and its dependent claims is overcome.

Claim 14 requires that the laminate organic substrate (12) has conductive vias (38) between the first and second surfaces (14,16) that thermally couple the device (18) to the localized stiffener (124). Under this rejection, the Examiner explained that Appelt discloses at column 7, lines 1-4, that "the laminate substrate has conductive vias between the first and second surfaces that thermally couple the device to the localized stiffener." However, the vias referred to be Appelt are not disclosed as being "conductive," i.e., filled or metallized to form a thermally conductive path (see Applicants' specification at page 7, lines 6-9), and appears to refer only to holes for the limited purpose of moderating the coefficient of thermal expansion of Appelt's baseplate (e.g., 200). Therefore, Applicants respectfully believe that Appelt does not disclose or suggest the invention recited in Applicants' independent claim 14.

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Also under this rejection, the Examiner cited Appelt's Figure 2 as disclosing "the localized stiffener is entirely encapsulated with an adhesive" (as recited in Applicants' claim 6), and cited Figure 2 and column 5, lines 47-48, of Appelt for disclosing an overmold circuit board assembly (as recited in Applicants' claim 17). However, Appelt's stiffener 210 is not disclosed as being encapsulated by anything - instead, the entire mass identified by reference number 210 and shown on Appelt's baseplate 200 is said to be INVAR and nothing more. Furthermore, Figure 2 and column 5, lines 47-48, of Appelt are limited to a device 230 with underfill 260, and not an "overmold" as the term is known and used in the art. Therefore, these grounds for rejecting the claims on the basis of Appelt are believed to be improper.

In view of the above, Applicants respectfully request withdrawal of the rejection to the claims based on Appelt.

Finally, dependent claims 9-11 were rejected under 35 USC §103(a) as being unpatentable over Appelt in view of U.S. Patent No. 5,958,556 to McCutcheon. However, the explanations for this rejection refer to Sylvester as being the primary reference, and therefore this rejection will be addressed as a combination of Sylvester and McCutcheon. Applicants respectfully request reconsideration of this rejection in view of the claims as amended and the

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following comments.

As noted above, independent claim 1 (from which claims 9-11 depend) requires that the surface-mount device (18) is attached with a plurality of solder bumps (20) to the first surface (14) of the laminate organic substrate (12), and that the stiffener (24,124,224) is attached with a plurality of solder bumps (126 in Figure 2) to the second surface (16) of the laminate organic substrate (12) directly opposite the device (18), and that the solder bumps (126) space the stiffener (24,124,224) from the laminate organic substrate (12) to define a gap therebetween. As noted above in Applicants' remarks directed to the rejection based on Sylvester along, Applicants believe that Sylvester does not disclose or suggest these limitations. Applicants further believe that McCutcheon also fails to disclose or suggest these limitations. As such, Applicants respectfully request withdrawal of the rejection to the claims based on the combination of Sylvester and McCutcheon.


Closing

In view of the above, Applicants believe that the claims define patentable novelty over all the references, alone or in combination, of record. It is therefore respectfully requested that this patent application be given favorable reconsideration.

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Should the Examiner have any questions with respect to any matter
now of record, Applicants' representative may be reached at (219) 462-4999.

Respectfully submitted,

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Attachment: Petition for Extension of Time